

PATENT COOPERATION TREATY

REC'D 17 AUG 2006

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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference AJC/P105743WO	FOR FURTHER ACTION		See Form PCT/IPEA/416
International application No. PCT/GB2005/001423	International filing date (day/month/year) 13.04.2005	Priority date (day/month/year) 13.04.2004	
International Patent Classification (IPC) or national classification and IPC INV. G21F9/28 G21F9/34 G21F9/36			
Applicant BRITISH NUCLEAR FUELS PLC			

<p>1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 6 sheets, including this cover sheet.</p> <p>3. This report is also accompanied by ANNEXES, comprising:</p> <p>a. <input checked="" type="checkbox"/> (<i>sent to the applicant and to the International Bureau</i>) a total of 5 sheets, as follows:</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions). <input type="checkbox"/> sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box. <p>b. <input type="checkbox"/> (<i>sent to the International Bureau only</i>) a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in electronic form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).</p>
<p>4. This report contains indications relating to the following items:</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> Box No. I Basis of the report <input type="checkbox"/> Box No. II Priority <input type="checkbox"/> Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability <input type="checkbox"/> Box No. IV Lack of unity of invention <input checked="" type="checkbox"/> Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement <input type="checkbox"/> Box No. VI Certain documents cited <input type="checkbox"/> Box No. VII Certain defects in the international application <input checked="" type="checkbox"/> Box No. VIII Certain observations on the international application

Date of submission of the demand 13.02.2006	Date of completion of this report 16.08.2006
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Lohberger, S Telephone No. +49 89 2399-6723



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Box No. I Basis of the report

1. With regard to the **language**, this report is based on

- the international application in the language in which it was filed
- a translation of the international application into , which is the language of a translation furnished for the purposes of:
 - international search (under Rules 12.3(a) and 23.1(b))
 - publication of the international application (under Rule 12.4(a))
 - international preliminary examination (under Rules 55.2(a) and/or 55.3(a))

2. With regard to the **elements*** of the international application, this report is based on (*replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report*):

Description, Pages

1-7 as originally filed

Claims, Numbers

1-37 received on 15.02.2006 with letter of 13.02.2006

- a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing

3. The amendments have resulted in the cancellation of:

- the description, pages
- the claims, Nos.
- the drawings, sheets/figs
- the sequence listing (*specify*):
- any table(s) related to sequence listing (*specify*):

4. This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

- the description, pages
- the claims, Nos.
- the drawings, sheets/figs
- the sequence listing (*specify*):
- any table(s) related to sequence listing (*specify*):

* If item 4 applies, some or all of these sheets may be marked "superseded."

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Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	6,14-22
	No:	Claims	1-5,7-13,23-37
Inventive step (IS)	Yes:	Claims	6,14-18
	No:	Claims	1-5,7-13,19-37
Industrial applicability (IA)	Yes:	Claims	1-37
	No:	Claims	

2. Citations and explanations (Rule 70.7):

see separate sheet

Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

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Re Item V.

1 Reference is made to the following documents:

- D1: WO 2004/006268 A (BRITISH NUCLEAR FUELS PLC; HOLICK, ADELE, CHARMAINE; HANIGAN, NICHOLA) 15 January 2004 (2004-01-15)
D2: US-A-4 432 666 (FREY ET AL) 21 February 1984 (1984-02-21)
D3: GB-A-2 187 727 (COAL INDUSTRY) 16 September 1987 (1987-09-16)
D4: GB-A-2 117 753 (PRINTSULATE LIMITED) 19 October 1983 (1983-10-19)

2 INDEPENDENT CLAIM 1

2.1 The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of claim 1 still is not new in the sense of Article 33(2) PCT.

Document D1 discloses (see especially description page 3, line 20 to page 5, line 5 and claims) a method for the encapsulation of uranium metal, wherein the metal is treated with an encapsulant of cementitious material (Portland cement) and said material additionally contains means for minimisation of the corrosion of said metal (PFA, organic or inorganic fluidizing agents, water content of 40 to 50%).

These compounds are present **within the cement matrix**.

Present Application explicitly states that PFA is a compound for minimisation of the corrosion of uranium in a cementitious material.

Present Application explicitly states that a reduced water content of 30 - 50% is a means for minimisation of the corrosion of uranium in a cementitious material. This as well is already disclosed in D1.

Present Application explicitly states that increased fluidity of the cementitious grout leads to reduced amount of water for its preparation and as such is a means for minimisation of the corrosion of uranium in a cementitious material. D1 discloses for this purpose organic and inorganic fluidizing agents.

3 INDEPENDENT CLAIM 37

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- 3.1 The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of claim 37 is not new in the sense of Article 33(2) PCT.
Document D1 discloses (see especially description page 3, line 20 to page 5, line 5 and claims) a method for the storage of uranium metal, wherein the metal is encapsulated in a cured cementitious material (Portland cement) and said material additionally contains means for minimisation of the corrosion of said metal within the cement matrix (PFA, organic or inorganic fluidizing agents, water content of 40 to 50%).
- 4 DEPENDENT CLAIMS 2-5, 7-13 and 23-36
Dependent claims 2-5, 7-13 and 23-36 do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of novelty and/or inventive step (Article 33(2) and (3) PCT).
5. Present claims 1 and 37 still are not in accordance with article 6 PCT due to lack of clarity. The expression "means for the minimisation of corrosion of said metal (uranium)" is vague and undefined. Therefore the scope of the claim is unclear. An airtight plastic bag around the metal as well falls under such unclear definition. Additionally the Applicant tries to define the subject-matter of the claim by the result to be achieved. Here this is not acceptable since a clear definition of these means can be given (three embodiments described in the description).
6. D2, especially description column 3, line 5 to column 4, line 28, example 14 and claims discloses a method for the encapsulation of heavy metal using a cementitious composition with a surfactant and polyacrylates as superplasticizers.
In the light of D1 it is evident to encapsulate uranium as well with the composition of D2. Especially D2 has the same problem to solve, encapsulation of waste metal of toxic nature and linked to it the same problems of avoiding the leaching of any toxic substances out of the hardened material. It is normal for a skilled man to look into such a document as well if he wants to have better properties of the hardened cement mixture. Consequently the subject-matter of present claims 1, and especially 19 to 22 is rendered obvious by a combination of D1 with D2 and therefore is not in

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accordance with article 33(2) PCT.

7. D3 and D4 disclose cementitious compositions with PFA and acrylic polymers (D3) or PFA, cellulose fibres and non-ionic surfactants. No hint can be found to use these compositions for encapsulating uranium metal. Therefore these documents are not considered to be of high relevance for present set of claims.

8. Present claims 6 and 14 to 18 disclose a specific means for the minimisation of corrosion of uranium which is an independent source of oxygen (inclusion of peroxide materials in the cement matrix). Such means are neither disclosed nor rendered obvious by the prior art as represented in the search report.
Consequently claims 6 and 14 to 18 fulfil the requirements of article 33 PCT.

CLAIMS

1. A method for the encapsulation of uranium metal which comprises treating the metal with an encapsulant which comprises a cementitious material and curing said cementitious material, wherein said process additionally comprises the provision within the cement matrix of means for the minimisation of the corrosion of said metal.
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2. A method as claimed in claim 1 wherein said uranium metal is comprised in waste material.
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3. A method as claimed in claim 1 or 2 wherein said means for the minimisation of the corrosion of said metal comprises means for the prevention of the corrosion of said metal.
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4. A method as claimed in claim 1, 2 or 3 wherein the mode for the provision of said means for the minimisation of corrosion comprises the provision of a source of oxygen within the cement matrix.
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5. A method as claimed in claim 4 wherein the provision of said source of oxygen within the cement matrix comprises facilitating enhanced oxygen access from the atmosphere.
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6. A method as claimed in claim 4 wherein the provision of said source of oxygen within the cement matrix comprises the inclusion of an independent source of oxygen.
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7. A method as claimed in claim 1, 2 or 3 wherein the mode for the provision of said means for the minimisation of corrosion comprises facilitating the minimisation of the water content of the matrix.

8. A method as claimed in any one of claims 1 to 7 wherein said means for the minimisation of the corrosion of said metal comprises a corrosion inhibiting material, said corrosion inhibiting material being added to said cementitious material.
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9. A method as claimed in claim 8 wherein said corrosion inhibiting material comprises at least one air entraining agent.
10. A method as claimed in claim 9 wherein said air entraining agent comprises at least one anionic or non-ionic surfactant.
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11. A method as claimed in claim 9 or 10 wherein said cementitious material comprises 0.01-2% (w/w) of an air-entraining agent.
- 15 12. A method as claimed in claim 8 wherein said corrosion inhibiting material comprises cenospheres.
13. A method as claimed in claim 12 wherein said cementitious material comprises 0.01-30% (w/w) of cenospheres.
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14. A method as claimed in claim 8 wherein said corrosion inhibiting material comprises at least one peroxide.
15. A method as claimed in claim 14 wherein said peroxide comprises an inorganic peroxide.
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16. A method as claimed in claim 15 wherein said inorganic peroxide comprises a peroxide of a metal from Group II of the Periodic Table.
- 30 17. A method as claimed in claim 16 wherein said peroxide comprises calcium peroxide or magnesium peroxide.

18. A method as claimed in any one of claims 14 to 17 wherein said cementitious material comprises 0.01-10% (w/w) peroxide.
19. A method as claimed in claim 7 wherein said corrosion inhibiting material comprises at least one superplasticiser.
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20. A method as claimed in claim 19 wherein said at least one superplasticiser comprises at least one surfactant.
- 10 21. A method as claimed in claim 20 wherein said surfactant comprises a polyacrylate or polycarboxylate.
22. A method as claimed in claim 19, 20 or 21 wherein said cementitious material comprises 0.01-5% (w/w) of superplasticiser.
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23. A method as claimed in any one of claims 1 to 22 wherein said cementitious material comprises Portland Cement.
24. A method as claimed in any preceding claim wherein the cementitious material additionally comprises one or more fillers.
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25. A method as claimed in claim 24 wherein said filler is selected from pulverised fuel ash, finely divided silica and organic and inorganic fluidising agents.
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26. A method as claimed in any preceding claim wherein the cementitious material is provided in the form of an aqueous composition.
27. A method as claimed in claim 26 wherein the water content of the composition is in the region of 30-50% (w/w).
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28. A method as claimed in claim 26 wherein the water content of the composition is in the region of 10-50% (w/w).
29. A method as claimed in any preceding claim wherein the uranium metal is placed in an appropriate container and a cementitious material is added and allowed to at least partially cure.
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30. A method as claimed in claim 29 wherein the container is subsequently capped.
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31. A method as claimed in claim 29 or 30 wherein the container comprises a drum having a capacity in the region of 500 litres.
32. A method as claimed in any one of claims 8 to 31 which comprises mixing of said cementitious material with said corrosion inhibiting material.
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33. A method as claimed in claim 32 wherein said mixing is effected in the container into which the uranium metal is placed.
- 20 34. A method as claimed in claim 32 wherein said mixing is carried out externally to the said container.
35. A method as claimed in claim 34 wherein said mixing is performed in a batchwise fashion prior to addition of the cementitious material to the container.
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36. A method as claimed in claim 34 wherein said mixing takes place in-line prior to the introduction of the cementitious material into the container.

37. A method for the storage of uranium metal which comprises encapsulation of the metal in a cured cementitious material comprising within the cement matrix means for the minimisation of the corrosion of said metal.

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